

Progress in *Juglans cinerea* Conservation: Genetic Diversity, Health, and Introgression

Keith Woeste¹ and Amy Ross-Davis²

¹Hardwood Tree Improvement and Regeneration Center, Purdue University and ²Department of Forestry and Natural Resources, Purdue University

The abundance of *Juglans cinerea* L. (butternut) is declining due to the exotic fungus *Sirococcus clavigignenti-juglandacearum*, which causes branch and stem cankers that ultimately girdle and kill host trees. Butternut freely hybridizes with two exotic species, namely Persian or English walnut (*Juglans regia* to form *Juglans* x *quadrangulata*) and Japanese walnut (*Juglans ailanthifolia* to form *Juglans* x *bixbyi*). These hybrids are vigorous, difficult to distinguish from butternut, produce large numbers of fruit and appear to be more resistant to butternut canker than butternut. A combination of nuclear microsatellite markers, RAPD (Randomly Amplified Polymorphic DNA) and morphology were used to distinguish *Juglans cinerea* from hybrids. Results are discussed in terms of their implications for understanding the extent of introgression in extant butternut populations. Because small populations typically exhibit reduced genetic diversity which, in turn, reduces fitness, we investigated genetic diversity and population structure. DNA was isolated from leaf samples collected from 422 butternut trees in five populations from throughout the species' native range and polymorphic nuclear microsatellites were used to estimate the genetic diversity and structure of these populations. Loci were highly polymorphic and most local populations contained at least one private allele. Heterozygosity levels indicate that the species remains locally genetically diverse despite high rates of infection and generally low levels of regeneration in the studied populations. Wright's F statistics indicate a slight overall heterozygote deficit and a moderate degree of genetic differentiation among local populations, results that suggest a trend toward isolation and inbreeding. Scattered healthy butternut trees, often associated with an uncommon "dark-barked" phenotype, have been documented among diseased and dying trees, which suggests the possibility of resistance. The current plans for resistance breeding for this species will be presented and discussed.